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Medical College of Virginia

UNPUBLISHED PRELIMINARY DATA

NASA Progress Report - Since May 1962

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Summary May, 1962 to the present

Since May, 1962, 28 experiments have been attempted of which 21 yielded satisfactory data. Early during this period, the considerable data analysis and literature survey were undertaken in preparation for the presentation of the paper "A Hysteresis - Like Phenomenon in the Response of the Cerebral Vessels to Alteration of Arterial Carbon Dioxide Tension" at the Scientific Sessions of the American Heart Association in Cleveland, Ohio in Oct., 1962. The abstract was published in the October supplement to Circulation and a manuscript is in semi-final draft.

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The bulk of experiments performed during this period have been concerned with the time course of the cerebrovascular response to a given level of inspired carbon dioxide. Initially, the experiments took measures of cerebral arteriovenous oxygen difference--$(A\text{-}V)O_2$, arterial CO_2 tension, end-tidal CO_2 tension and arterial pressure during a 5-8 minute exposure to 3, 5 and 7% CO_2 for 5-8 minutes, as well as during the 2-3 minutes following return to room air. In 5 recent experiments rapid, manual sampling from the jugular bulb has allowed measures of jugular venous CO_2 tension as well. These experiments allow analysis of the simultaneous pattern of response of arterial CO_2 tension, cerebral blood flow, as indicated by cerebral $(A\text{-}V)O_2$, and jugular venous PCO_2 to a given level of inspired carbon dioxide. The arterial PCO_2 takes approximately 2.5 to 3 minutes to achieve a plateau value. There may be slight variations subsequently in this level. The jugular venous PCO_2 follows the arterial closely but may lag behind by as much as one minute. Cerebral blood flow achieves

its peak level in from 0 to 120 seconds after the arterial peak PCO_2 is reached or as much as 4 minutes after the initial exposure to carbon dioxide. The arterial lag time might well be primarily a result of the "buffer" effect of the lungs. The further delay of cerebral blood flow may well be due to the hysteresis phenomenon described in the previous years' work. It would appear both from the previous experimental design as well as this one that the hysteresis is not of comparable magnitude in every individual. In several experiments where venous PCO_2 data were available, the cerebral blood flow lagged behind this as well as in achieving its peak. Observation of the overall pattern in this experiment reveals that while arterial and jugular venous CO_2 tensions were similar in their behavior, the changes in blood flow corresponded more closely to the fluctuations in arterial carbon dioxide tensions. After the 5-8 minute period on CO_2, the subject was once more given room air. It often took 1-2 minutes before arterial CO_2 tension and cerebral blood flow achieved control levels. This series is currently nearing completion.